

Forest Pest Management Pacific Northwest Region



FOREST PEST SURVEY
SOUTH FRISSELL TIMBER SALE
BLUE RIVER RANGER DISTRICT
WILLAMETTE NATIONAL FOREST



Prepared by: Donald J. Goheen
DONALD J. GOHEEN, Plant Pathologist

9/7/82
Date

Craig L. Schmitt
CRAIG L. SCHMITT, Plant Pathologist

9/7/82
Date

Alan M. Kanaskie
ALAN M. KANASKIE, Biological Technician

9/7/82
Date

Susan Frankel
SUSAN J. FRANKEL, Biological Technician

9/7/82
Date

Reviewed by: James S. Hadfield
JAMES S. HADFIELD, Supervisory Pathologist

9/7/82
Date

Approved by: Paul E. Buffam
for PAUL E. BUFFAM, Director, FPM

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Date

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Forest Pest Survey, South Frissell Timber Sale
Blue River Ranger District, Willamette National Forest

By

Donald J. Goheen, Plant Pathologist
Craig L. Schmitt, Plant Pathologist
Alan M. Kanaskie, Biological Technician
Susan J. Frankel, Biological Technician

USDA Forest Service
Pacific Northwest Region
Forest Pest Management
Portland, Oregon

Introduction

During the weeks of April 27-30 and May 4-7, 1982, a FPM pathology crew did a forest pest survey of the South Frissell Timber Sale, Blue River Ranger District, Willamette National Forest (T. 18 S., R. 6 E., sec. 33 and T. 19 S., R. 5½ E., sec. 2). District personnel had noticed considerable amounts of tree mortality and blowdown in this unit and suspected that root disease was responsible. They requested a biological evaluation to determine distribution and intensity of disease and insect activity in the sale area and to provide pest management recommendations.

Methods

Approximately 600 acres were surveyed systematically using a variable plot method. A Spiegel-Relaskop was employed to define each plot, and a basal area factor of 40 was used as a standard. Plots were located on a 5x5 chain grid across the unit. All trees within each plot were examined and the following information recorded: tree species, DBH, general condition (live, dead, standing, down), and presence of disease and insect infestation. Two roots on opposite sides of each dead or symptomatic tree were excavated to a distance of 3 feet from the root collar and examined for evidence of root diseases. Roots and butts of old dead trees were dissected to determine the character of wood decay. Trunks were examined for signs and symptoms of heartrot, and bark was removed from stems of bark beetle-infested trees to expose galleries for beetle species determination. Crowns of all trees were examined for signs and symptoms of such diseases as dwarf mistletoes and rusts. From data collected in plots, mean basal area, number of trees, and volume per acre by tree species, DBH class, and condition were calculated.

In addition to collecting data at plots, the survey crew reconnoitered areas between plots and lines and prepared maps showing the locations of all root disease centers encountered. Boundaries were determined based on occurrence of dead or symptomatic diseased trees.

Results and Discussion

The South Frissell Unit includes relatively flat, high site lands along the South Fork of the McKenzie and Roaring Rivers, moderately rich, midslope sites along Moss Creek and other small unnamed creeks, and steep, rocky ridges below the peak of Chucksney Mountain. The survey area and location of plots within it are shown in Figures 1 and 2.

The stand on the South Frissell Unit is dominated by 100- to 250-year-old Douglas-fir (*Pseudotsuga menziesii*), includes some grand fir (*Abies grandis*) and western hemlock (*Tsuga heterophylla*), and has minor components of western redcedar (*Thuja plicata*), incense cedar (*Libocedrus decurrens*), Engelmann spruce (*Picea engelmannii*), noble fir (*A. procera*), and ponderosa pine (*Pinus ponderosa*). The stand formerly contained a substantial amount of western white pine (*P. monticola*), but most is now dead.

Mean basal areas, number of trees, and board foot volumes per acre for the survey unit are summarized in Tables 1, 2, and 3. Dead trees accounted for 9 percent of the basal area, 19 percent of the stems, and 9 percent of the volume. Three forest pests, *Phellinus* (*Poria*) *weirii*, cause of laminated root rot; the Douglas-fir beetle, *Dendroctonus pseudotsugae*; and the mountain pine beetle, *D. ponderosae*, contributed to much of this loss. Forest managers planning harvest and silvicultural prescriptions for the South Frissell Unit should give these pests careful consideration. They are discussed in more detail in the following sections.

Laminated Root Rot - By far the most frequently encountered and damaging disease in the stand was laminated root rot, caused by the fungus *P. weirii*. This disease was identified by the typical laminated wood decay that separates readily at the growth rings, the reddish, whiskery setal hyphae that appear between the sheets of rotted wood, and the grayish, crusty ectotrophic mycelia that the causal fungus forms on root bark (Figures 3 and 4). Many infected trees had been windthrown and exhibited root balls characteristic of laminated root rot (Figure 5).

Laminated root rot was found in 11 percent of the survey plots, and, based on the sketch map, infection centers encompassed almost 20 percent of the survey area (Figures 1 and 2). Within infection centers, 30 percent of the trees were dead or windthrown and 14 percent, though living, had advanced infections (ectotrophic mycelia detectable at the root crown). There were islands of healthy appearing trees within centers, but many of these trees as well as healthy looking trees directly around the center margins probably are infected far out on their roots. Based on recent studies done in British Columbia and eastern Washington, we would suspect that approximately 50 percent of non-symptomatic trees in centers and within 50 feet of apparent center boundaries have such infections. Throughout the survey area, tree stocking (including all trees, both live and dead) averaged about 10 percent less in infection centers than in surrounding healthy portions of the stand.

Laminated root rot is an especially dangerous disease, not only because of its devastating effects on a currently infected stand, but because the causal agent is persistent on the site. The fungus can survive for long time periods (up to 50 years) in roots of old stumps, infecting new hosts that become established

on the site via root contacts. New infection centers develop and increase in size due to subsequent spread from tree to tree along roots. Thus laminated root rot, if left untreated, not only poses continuing hazard to existing stands on the South Frissell Sale Area, but also to future generations that may be established on the unit.

Recommended control for laminated root rot is to cut all susceptible hosts in infection centers and a 50-foot buffer around each, and either (1) mechanically remove all inoculum (infected roots and stumps) with heavy equipment, or (2) leave inoculum but replant with immune, resistant, tolerant, or intermediately susceptible tree species that are adapted to the site. Mechanical removal of inoculum is effective and allows the manager to replant with any tree species desired, but it is very expensive, difficult on steep terrain, and may contribute to substantial soil damage. Tree species manipulation in disease centers is usually a more viable control alternative.

In the South Frissell area, tree species by increasing degree of susceptibility are: immune-hardwoods; resistant-western redcedar, incense cedar, ponderosa pines; tolerant-western white pine; intermediately susceptible-western hemlock, noble fir, Engelmann spruce; highly susceptible-Douglas-fir, grand fir. If only immune species are planted on an infected site and grown for a rotation (50 years or more), *P. weirii* will die out and a highly susceptible species such as Douglas-fir could be grown in the following rotation with almost no likelihood of additional losses. If resistant or tolerant species are used, there should be much the same result, although there may be a small amount of infection and retention of the pathogen. If intermediately susceptible species are grown for a rotation, they should suffer little damage. However, many will be infected, a few may die, and the disease will be maintained on the site. Planting with Douglas-fir or another highly susceptible species in the subsequent rotation would prolong and intensify the problem.

Douglas-fir Beetle - Douglas-firs infested by the Douglas-fir beetle were found throughout the South Frissell Unit. Douglas-fir beetle had infested 32 percent of the dead Douglas-firs encountered in the survey, though in many cases, the trees had been windthrown or infected by *P. weirii* prior to beetle attack. Douglas-fir beetle activity was greatest in the northern part of the stand, especially around the large laminated root rot pockets.

For the most part the Douglas-fir beetle is not a primary tree killer. It usually attacks and breeds in diseased, injured, or windthrown trees. However, if there are many trees of this type widely distributed in a stand, Douglas-fir beetle populations may build up to high levels and may attack nearby healthy, standing trees. This has occurred in the past in the South Frissell Unit and, unfortunately, with the large amount of root disease and the substantial quantity of windthrow that occurred during the past winter, the stage is set for another outbreak.

Control of Douglas-fir bark beetle is attained by promoting and maintaining a vigorous stand. Weak and injured trees should be removed before beetles can attack them or, if already infested, before the next generation of beetles emerges. If large numbers of trees have been windthrown in an area (5 per acre or more), they should be salvaged before April of the following year.

Mountain Pine Beetle - Virtually all of the western white pine in the South Frissell Unit has been infested and killed by the mountain pine beetle. This bark beetle exhibits a well-developed ability to locate and kill western white pines, even scattered individuals, that have reached advanced ages and occur in stands with high basal areas. The stand on the South Frissell Unit has lost its white pine component primarily because it is now too old and too heavily stocked for the species. Mountain pine beetle also infest trees weakened by white pine blister rust, and occurrence of this disease undoubtedly contributed to the large amount of infestation in the sale area.

To prevent mountain pine beetle damage in western white pine stands, several precautions should be taken: (1) use blister rust-resistant planting stock, (2) employ careful stocking control; stands should be thinned so that stocking levels never exceed 150 ft.² of basal area, and (3) manage stands on rotations of 120 years or less.

Other Forest Pests - In addition to laminated root rot, Douglas-fir beetle, and mountain pine beetle, several other forest pests were observed less frequently in the South Frissell Unit. These included *Armillaria* root rot (caused by the fungus *Armillaria mellea*), annosus root rot (caused by *Fomes annosus*), white pine blister rust (caused by *Cronartium ribicola*), red ring rot (caused by *Phellinus (Fomes) pini*), brown cubical butt rot (caused by *Phaeolus (Polyporus) schweinitzii*), fir engraver beetle (*Scolytus ventralis*), flatheaded borers (members of the family Buprestidae), and roundheaded borers (members of the family Cerambycidae). Most of these pests occurred at rather minor levels, but the management implications of at least three should be recognized. Occurrence of white pine blister rust on a high percentage of the few young western white pine observed in the stand indicates that the South Frissell Unit is probably a high-hazard area for this disease. Blister rust is best controlled by use of selected, resistant planting stock. Occurrence of conks of *P. pini* on 4 percent and *P. schweinitzii* on 2 percent of the Douglas-firs indicates that there will be some wood lost to decay in the South Frissell Unit. Decay losses caused by these fungi are greatest in old-growth trees and can be minimized by shortening rotations.

Management Recommendations

Specific pest management recommendations aimed at maximizing wood production and promoting stand health and vigor in the South Frissell Unit are as follows:

(1) Harvesting plans and priorities - Ideally, we would like to see harvesting concentrated in and around the major laminated root rot centers identified in our survey and outlined in Figures 1 and 2. Top priority should be given to harvesting and treating the large disease pockets in the centers of the unit and along the western boundary. These disease pockets are particularly active, and tree loss in them appears to be accelerating. We recommend clearcutting entire infected areas and a 50-foot buffer around each. We strongly recommend against cutting in healthy portions of the stand adjacent to diseased areas without also cutting the disease pockets. Opening up the edge of a disease pocket by clearcutting an adjacent block will result in unacceptable increases in windthrow.

In addition to concentrating harvest in diseased areas, we suggest that as soon as roads are completed into the unit, an active program of blowdown salvage be instituted, especially in the western portion of the unit. Salvage

operations should be carried out whenever more than five trees per acre have come down. Broken and blown down trees should be removed before April of the year following that in which they fell (i.e., those windthrown in November 1981 should be removed before April 1983). Every effort should be made to minimize injury to residual trees during the salvage operations.

(2) Silvicultural prescriptions - (a) Regeneration - Tree species susceptible to laminated root rot should not be replanted in disease centers. We believe that if Douglas-fir were to be replanted in disease pockets on the South Frissell Unit in the next rotation, there would be a productivity loss at time of harvest of 50 to 60 percent (i.e., stands would produce only 40 to 50 percent as much wood as healthy stands on comparable sites). Furthermore, these losses would intensify and involve more area in subsequent rotations. Rather, we recommend planting western white pine in a mixture with at least one other resistant or intermediately susceptible tree species in disease pockets. In the western portion of the unit, western redcedar could be used. In the remainder of the sale area, western hemlock is probably the best choice. If ponderosa pine and/or incense cedar stock that is adapted to the site is available, these species might also be considered for planting. Western white pine to be used in planting disease centers should be blister rust-resistant material screened by the Dorena Tree Improvement Center; (b) Stocking control - In future precommercial and commercial thinning entries, areas of the stand regenerated with western white pine should be thinned to such a level that basal area will not exceed 150 ft.² by the time of the next entry. In disease pockets treated by planting resistant, tolerant, and/or intermediately susceptible tree species, Douglas-fir and grand fir that has seeded in naturally should be discriminated against in thinning operations; (c) Rotation length - all managed stands in the South Frissell Unit should have rotations of 120 years or less. This applies to Douglas-fir stands established in disease-free portions of the site as well as mixed pine-hemlock or pine-cedar stands developed in disease pockets.

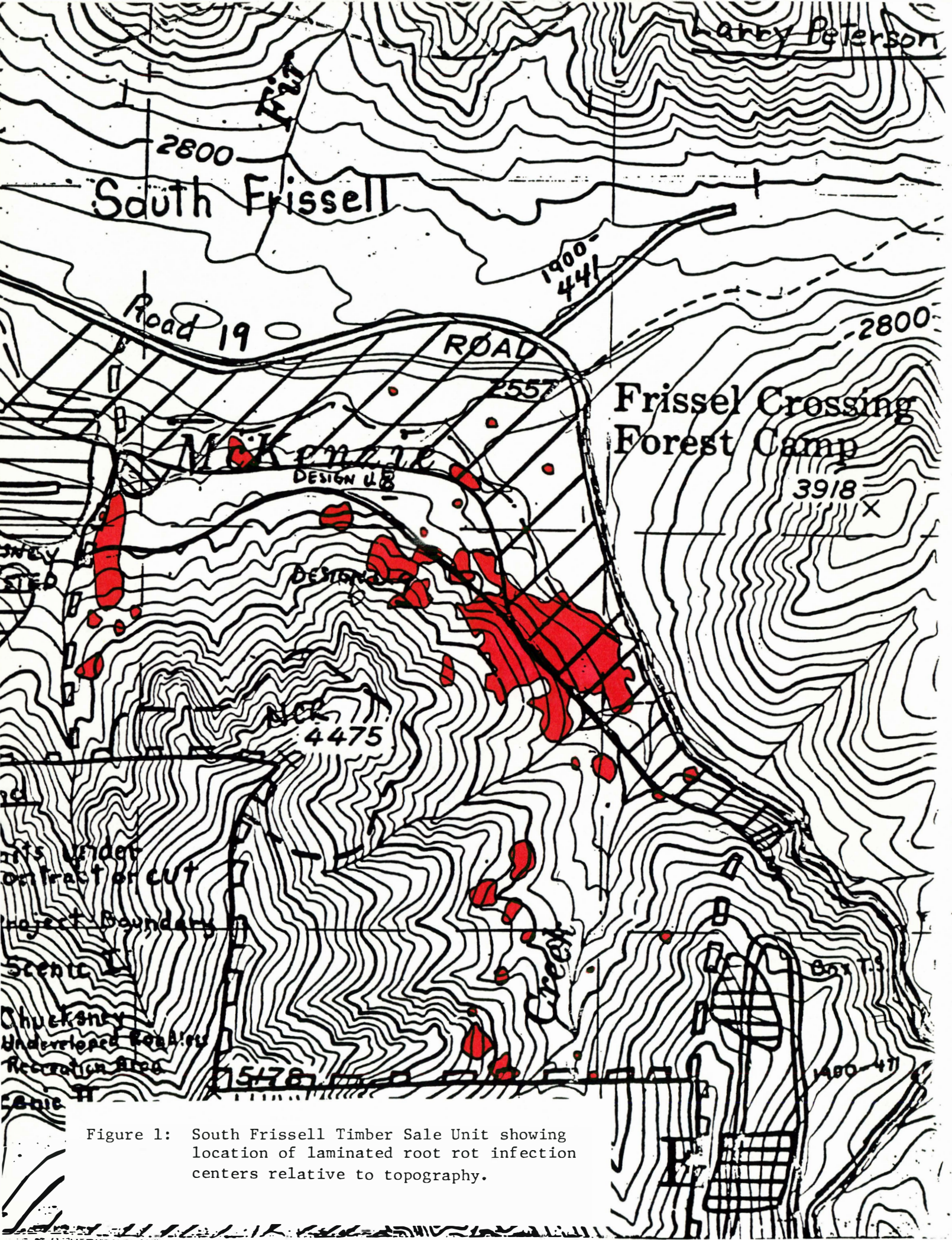
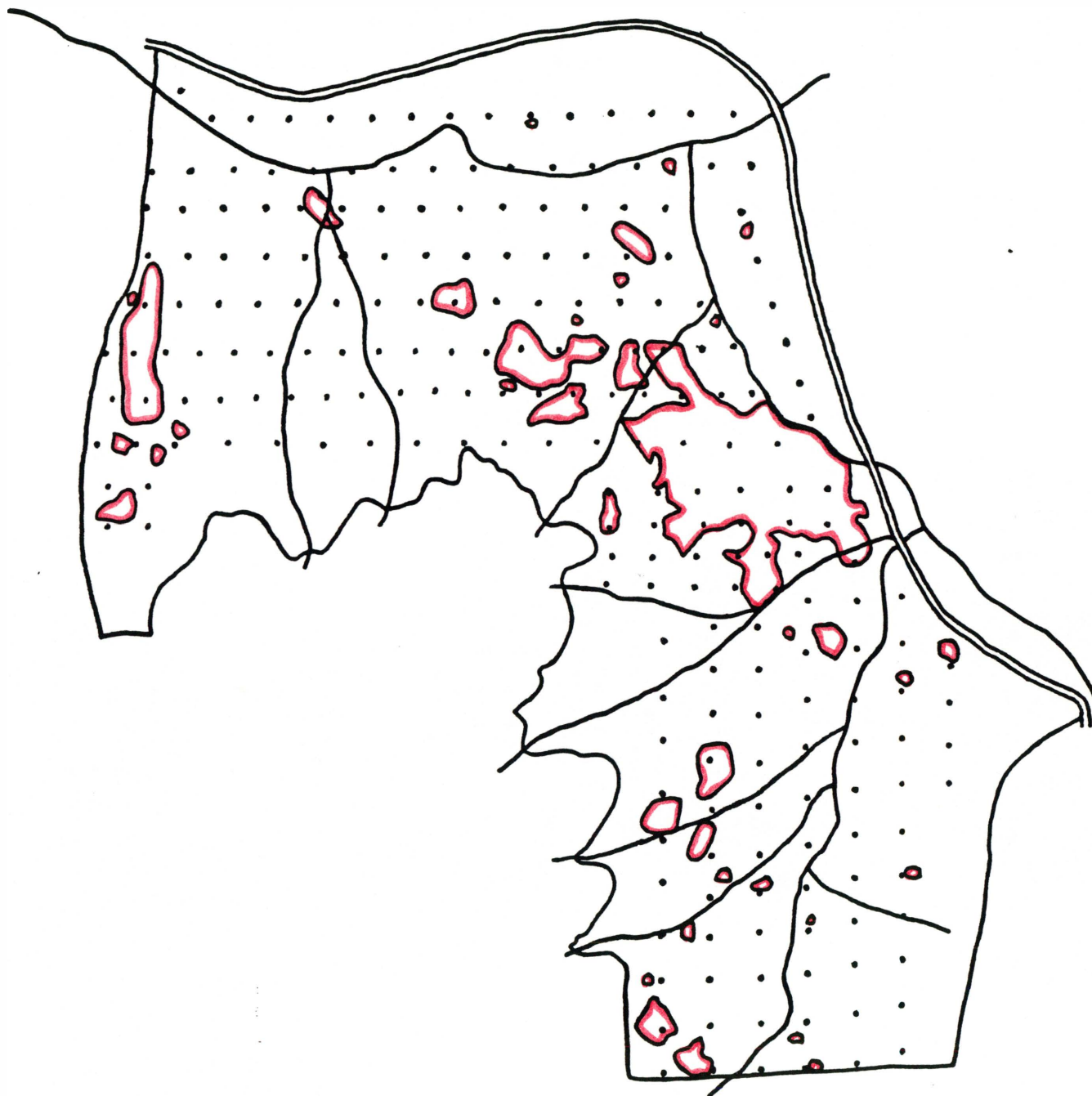


Figure 1: South Frissell Timber Sale Unit showing location of laminated root rot infection centers relative to topography.

Figure 2: South Frissell Timber Sale showing location of sample plots and laminated root rot centers.



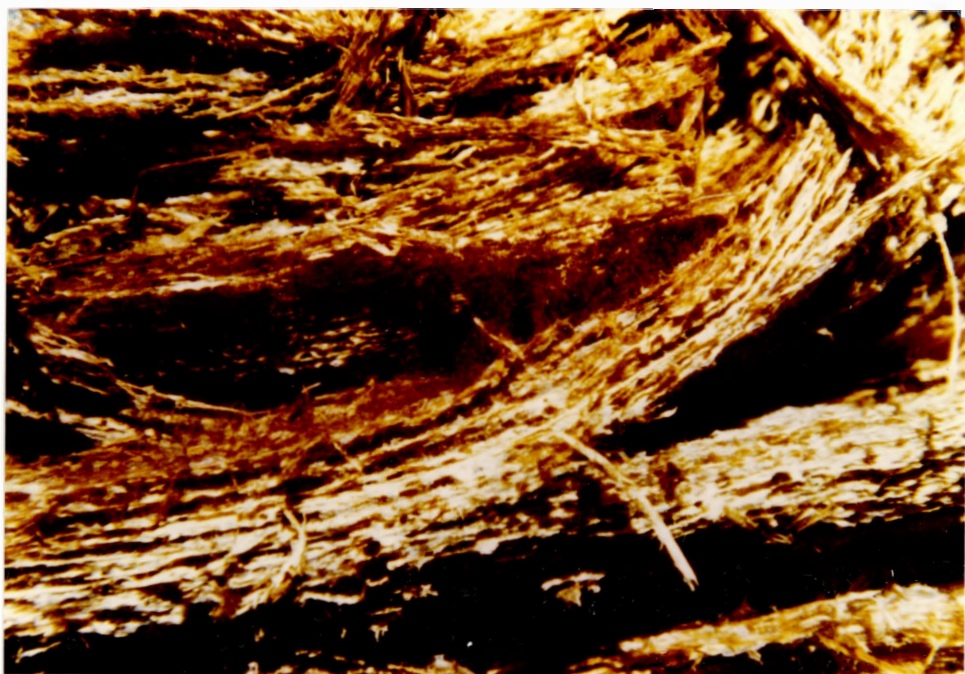


Figure 3. Laminated decay and setal hyphae of *Phellinus weirii* in Douglas-fir wood.



Figure 4. Ectotrophic mycelium of *Phellinus weirii* on excavated Douglas-fir root.



Figure 5. Windthrown tree exhibiting "root ball" typical of laminated root rot.

Table 1. Mean per acre basal area (ft.²) by DBH, species, and tree condition, South Frissell Sale Area

DBH Class	Douglas-fir		Grand Fir		Western Hemlock		Western White Pine		Ponderosa Pine		All Species	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
8	1.6	1.0	0	0	1.6	0	0	0	0	0	3.2	1.0
10	3.6	1.2	0	0	0.8	0	0	0	0	0	4.4	1.2
12	1.6	2.6	0	0	0	0	0	0.9	0	0	1.6	3.5
14	8.0	1.7	0	0.2	0	0	0	0.5	0	0	8.0	2.4
16	14.4	1.2	0	0	0.8	0	0	0.2	0	0	15.2	1.4
18	3.8	1.6	0	0.2	0	0	0	0.7	0	0	3.8	2.5
20	10.0	2.2	1.6	0	0	0	0	1.4	0	0	11.6	3.6
22	25.8	3.0	0.8	0.4	0	0	0	1.0	0	0	26.6	4.4
24	18.2	3.6	0.8	0.2	0	0	0	0.7	0	0.2	19.0	4.7
26	30.0	1.6	0.8	0	0	0	0	0.2	0	0	30.8	1.8
28	25.6	1.2	0	0	0	0	0	0.4	0	0	25.6	1.6
30	24.8	0.7	0	0	0	0	0	0.2	0	0	24.8	0.9
32	18.0	0.9	1.6	0	0	0	0	0	0	0	19.6	0.9
34	14.4	0.2	0	0	0	0	0	0	0	0	14.4	0.2
36	9.4	0	0	0	0	0	0	0	0	0	9.4	0
38	6.4	0.4	0	0	0	0	0	0	0	0	6.4	0.4
40	10.0	0	0	0	0	0	0	0	0	0	10.0	0
42	5.8	0.3	0	0	0	0	0	0	0	0	5.8	0.3
44	2.8	0	0	0	0	0	0	0	0	0	2.8	0
46	3.0	0	0	0	0	0	0	0	0	0	3.0	0
48	1.6	0	0	0	0	0	0	0	0	0	1.6	0
50	2.8	0	0	0	0	0	0	0	0	0	2.8	0
52	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
56	2.8	0	0	0	0	0	0	0	0	0	2.8	0
58	0.8	0	0	0	0	0	0	0	0	0	0.8	0
60	0	0	0	0	0	0	0	0	0	0	0	0
62	0.8	0	0	0	0	0	0	0	0	0	0.8	0
All Classes	318.0	23.4	5.6	1.0	3.2	0	0	6.2	0	0.2	326.8	30.8

Table 2. Mean number of trees per acre by DBH, species, and tree condition, South Frissell Sale Area

DBH Class	<u>Douglas-fir</u>		<u>Grand Fir</u>		<u>Western Hemlock</u>		<u>Western White Pine</u>		<u>Ponderosa Pine</u>		<u>All Species</u>	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
8	4.58	2.98	0	0	4.58	0	0	0	0	0	9.16	2.98
10	6.60	2.20	0	0	1.47	0	0	0	0	0	8.07	2.20
12	2.04	3.31	0	0	0	0	0	1.12	0	0	2.04	4.43
14	7.48	1.61	0	0.15	0	0	0	0.49	0	0	7.48	2.25
16	10.31	0.89	0	0	0.57	0	0	0.11	0	0	10.88	1.00
18	2.13	0.90	0	0.09	0	0	0	0.38	0	0	2.13	1.37
20	4.58	1.03	0.73	0	0	0	0	0.64	0	0	5.31	1.67
22	9.76	1.12	0.30	0.14	0	0	0	0.39	0	0	10.06	1.65
24	5.78	1.16	0.25	0.05	0	0	0	0.22	0	0.05	6.03	1.48
26	8.14	0.42	0.22	0	0	0	0	0.04	0	0	8.36	0.46
28	5.98	0.28	0	0	0	0	0	0.08	0	0	5.98	0.36
30	5.04	0.28	0	0	0	0	0	0.03	0	0	5.04	0.31
32	3.22	0.15	0.29	0	0	0	0	0	0	0	3.51	0.15
34	2.28	0.02	0	0	0	0	0	0	0	0	2.28	0.02
36	1.32	0	0	0	0	0	0	0	0	0	1.32	0
38	0.81	0.04	0	0	0	0	0	0	0	0	0.81	0.04
40	1.14	0	0	0	0	0	0	0	0	0	1.14	0
42	0.60	0.03	0	0	0	0	0	0	0	0	0.60	0.03
44	0.26	0	0	0	0	0	0	0	0	0	0.26	0
46	0.24	0	0	0	0	0	0	0	0	0	0.24	0
48	0.13	0	0	0	0	0	0	0	0	0	0.13	0
50	0.20	0	0	0	0	0	0	0	0	0	0.20	0
52	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
56	0.16	0	0	0	0	0	0	0	0	0	0.16	0
58	0.04	0	0	0	0	0	0	0	0	0	0.04	0
60	0	0	0	0	0	0	0	0	0	0	0	0
62	0.04	0	0	0	0	0	0	0	0	0	0.04	0
All Classes	82.86	16.42	1.79	0.43	6.62	0	0	3.50	0	0.05	91.27	20.85

Table 3. Mean volume (bdft) per acre by DBH, species, and tree condition, South Frissell Sale Area

DBH Class	<u>Douglas-fir</u>		<u>Grand Fir</u>		<u>Western Hemlock</u>		<u>Western White Pine</u>		<u>Ponderosa Pine</u>		<u>All Species</u>	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
8	.228	.149	0	0	.228	0	0	0	0	0	.457	.149
10	.553	.184	0	0	.123	0	0	0	0	0	.676	.184
12	.228	.372	0	0	0	0	0	.126	0	0	.228	.497
14	1.395	.300	0	.028	0	0	0	.092	0	0	1.395	.420
16	3.595	.311	0	0	.199	0	0	.038	0	0	3.793	.349
18	.886	.374	0	.034	0	0	0	.158	0	0	.886	.570
20	2.228	.501	.355	0	0	0	0	.311	0	0	2.584	.812
22	5.949	.682	.182	.085	0	0	0	.238	0	0	6.131	1.005
24	4.164	.835	.180	.036	0	0	0	.158	0	.036	4.343	1.066
26	7.392	.381	.200	0	0	0	0	.036	0	0	7.592	.418
28	6.004	.281	0	0	0	0	0	.080	0	0	6.004	.361
30	7.526	.418	0	0	0	0	0	.045	0	0	7.526	.462
32	5.282	.246	.476	0	0	0	0	0	0	0	5.758	.246
34	4.111	.036	0	0	0	0	0	0	0	0	4.111	.036
36	2.789	0	0	0	0	0	0	0	0	0	2.789	0
38	2.138	.105	0	0	0	0	0	0	0	0	2.070	.105
40	3.105	0	0	0	0	0	0	0	0	0	3.105	0
42	2.022	.101	0	0	0	0	0	0	0	0	1.941	.101
44	.843	0	0	0	0	0	0	0	0	0	.843	0
46	.846	0	0	0	0	0	0	0	0	0	.846	0
48	.589	0	0	0	0	0	0	0	0	0	.589	0
50	.958	0	0	0	0	0	0	0	0	0	.958	0
52	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0
56	.969	0	0	0	0	0	0	0	0	0	.969	0
58	.262	0	0	0	0	0	0	0	0	0	.262	0
60	0	0	0	0	0	0	0	0	0	0	0	0
62	.261	0	0	0	0	0	0	0	0	0	.261	0
All Classes	64.323	5.277	1.393	.188	.550	0	0	1.281	0	.036	66.266	6.782